ECONOMIC BURDEN-SHARING IN MILITARY ALLIANCES

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THESIS

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September 1973

Economic Burden-Sharing in Military Alliances

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN OPERATIONS RESEARCH

from the

NAVAL POSTGRADUATE SCHOOL
September 1973

ABSTRACT

It has been claimed that the United States is bearing a disproportionate share of the burden of the alliance system in which it is involved. In this thesis, two prominent concepts used for explaining military alliances, balance of power and the theory of collective goods, were studied to determine if they provide precise answers on the subject of burden-sharing. It was concluded that the balance of power philosophy is far too subjective to provide any precise answer. On the other hand, the theory of collective goods, as authored by Olson and Zeckhauser, yields the conclusion that a positive correlation exists between the size of a country's income and the size of its contribution to the alliance. However, their conclusion holds only when the alliance is in equilibrium and when their other assumptions are met. It is, therefore, of limited applicability.

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I. INTRODUCTION

A. PROBLEM STATEMENT AND PURPOSE

The United States is currently a member of eight bilateral or multilateral mutual security treaties or alliances (See Appendix A). These alliances, the product of American foreign policy in the post-World War II era, have been the subject of much debate in recent years. A major question arising from these debates concerns the subject of burden-sharing by the members of these alliances. Stated more precisely, is the United States bearing a disproportionate share of the burden of its alliance system? In relation to the European members of NATO, for example, one analyst of American foreign policy has stated:

> "Two decades after a war from which they have long since recovered economically, they show few signs of fulfilling the original post-war expectation that they would assume the major burden of their own defense in return for an American guarantee."[1]

The debates on the question of burden-sharing have been quite subjective in nature and, as a result, have not led to any precise answer. The purpose of this paper is to address the problem of economic burden-sharing in alliances to determine if a precise answer can be found. Two prominent concepts for explaining the "raison d'entre" of alliances, balance of power and the theory of collective goods, will be studied to

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[1] Russett, Bruce M., What Price Vigilance? The Burdens of National Defense, p. 92, Yale University Press, 1970.

determine if they provide the quantitative analysis necessary for the precison desired.

The study is organized in the following manner. The remainder of Chapter I addresses the origin of the alliance system and the reasons for questioning its necessity today. Chapter II contains a discussion on the role of alliances and commitments in international politics. The concept of balance of power is presented in Chapter III and the theory of collective goods in Chapter IV. Chapter V contains the conclusions.

In summary, this paper will show that the balance of power concept is not suited to quantitative analysis due to its subjective nature. The theory of collective goods lends itself to quantitative analysis and does answer the question on burden-sharing, but the assumptions made for its use limit its applicability.

B. BACKGROUND

1. Containment Policy

Following World War II, the Soviet Union under Stalin challenged the independence and security of the free world. Communism had spread to China. Eastern Europe was effectively under the control of the Soviet Union. Soviet troops had occupied Iran for a period of time. Pressure was applied on Turkey to concede the straits to the Aegean Sea to Russia. Communist inspired civil war had resumed in Greece. Berlin was

blockaded in 1948, and Korea was invaded in 1950.[2] These events precipitated the opinion within the United States that its primary goal of foreign policy must be the containment of the expansionist movement by the Soviet Union and other countries.[3] This foreign policy, and its military counterpart, the strategy of deterrence, which was based on the exploitation of a superior nuclear technology, became manifest in four parts:

1) A system of bilateral and multilateral military alliances which began in 1947 and continued through 1954 and which included most of the noncommunist countries of Europe and Asia, as well as Latin America (See Appendix A);

2) the overseas deployment of American military forces to strengthen the position of America's allies and to reflect the seriousness of its intentions to all adversaries;

3) the maintenance of much larger and more diversified military forces, including nuclear capabilities, than ever before by the United States during peacetime; and

4) the achievement of much higher levels of combat readiness by United States forces than had been accepted under previous mobilization strategies.[4]

This policy was considered technically correct in that it enabled the United States to avoid the use of military

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[2] Huntington, Samuel P., "After Containment: The Functions of the Military Establishment", American Academy of Political and Social Sciences. The Annals, v. 406, p. 2-3, March 1973.

[3] Ibid., P. 3.

[4] Ibid.

force to achieve some diplomatic or political goal. In essence, the goal of containment was served by the means of a deterrence achieved by alliances and armaments.[5] At the time this policy was formed and for several years thereafter, the United States had sufficient means to implement it. The American economy was over twice the size of the Soviet economy.[6] The distinct nuclear advantage the United States enjoyed virtually eliminated the possibility of a first strike by the Soviet Union. Also, the American air and naval power made it possible to deploy military forces anywhere in the world quite rapidly. Finally, the United States enjoyed political and economic hegemony in the non-communist world.[7]

The rest of the nations of this alliance system, having been economically weakened by World War II, or in an underdeveloped state, were forced to allocate their resources to internal development. They were not able to grow economically and improve their defense capability concurrently. In this environment, United States' military expenditures for their protection were believed to be consistent with its role in the free world.

2. The Changing World Environment

Although the United States remains the strongest nation in the world, the world environment has changed in the

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[5] Ibid., p. 4.

[6] Ibid.

[7] Ibid.

last two decades. This change has been generated by four major factors, and it has resulted in a relative decline in American power.[8] These factors are:

1) The rise of Soviet military power resulting in strategic parity with the United States;

2) the rise of regionally dominant powers such as Brazil in Latin America, Israel in the Middle East, and North Vietnam in Indochina, which have replaced American influence in those areas;

3) the disaffection with militarism which now seems to dominate the American scene; and

4) the rise of Japanese, Arab, and European economies.[9]

A discussion of these factors will show why this relative decline has occurred.

The rise of regional powers and the attainment of strategic parity, especially in terms of nuclear warhead delivery systems, by the Soviet Union have virtually destroyed the territorial concept of security reflected by containment and deterrence policies. It can be argued, and the isolationists do, that in view of this, alliances are unnecessary and reflect a philosophy of power politics that is inappropriate in today's world.[10]

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[8] Ibid.

[9] Ibid., p. 4-5.

[10] Tucker, Robert W., A New Isolationism: Threat or Promise?, p. 22, Universe Books, 1972.

American involvement in Southeast Asia is one consequence of reliance upon a containment policy. The costs of that involvement have not been fully assessed and may not for several years. However, it seems apparent that public opinion is now very much against future Vietnam-type military interventions and the subsequent burden in dollars and lives. The recent congressional action on the use of American military aircraft in Cambodia typifies this opinion.

Although the United States still has the largest GNP in the world, it no longer dominates the world economically. Japan, Europe and the Arab oil states are now major economic forces and must be treated accordingly. In the period 1961 to 1970, the United States realized a percentage increase in its GNP of 87.3. In contrast, the percentage increase for Japan was 271.0 during the same period. Also, of the European members of NATO, only the United Kingdom and Turkey have not realized a percentage increase in GNP greater than the United States.[11]

These four factors reveal that some nations of the world are decreasing the difference militarily and economically between themselves and the United States. The result is a relative decline in American power. The economic impact of these factors, however, is more relevant to this study, because it is from this that the problem of burden-sharing in the American alliance system arises.

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[11] United States Arms Control and Disarmament Agency (USACDA), World Military Expenditures, 1971, p. 22-23, 1972.

As mentioned previously, one purpose the United States had in forming its alliance system was to provide an umbrella of deterrence under which the less developed members could concentrate their resources on economic growth instead of defense. That economic growth has occurred. However, these countries were expected to make investments for their own defense, thus augmenting the deterrence capability of the alliances, concurrent with their economic growth. A conflict of goals ensued. The United States could not expect its allies to make investments in their own economic growth and provide their resources for augmenting the alliance simultaneously.[12] This conflict was resolved by the allies to their advantage. The economic growth rates surpass that of the United States in many instances, but the same is not true for the percentage increase in military expenditures. In several instances, the percentage change in military expenditures does not surpass that of the United States.

This situation lends substance to the arguments of those Americans opposed to the alliance system. They see allies growing richer at American expense. This leads to the statement that the United States is bearing a disproportionate share of the burden of its alliance system, which prompts debates on the subject.

The purpose of this thesis is to study two prominent concepts for explaining alliances, balance of power and the

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[12] Russett, op. cit., p. 93.

theory of collective goods, to determine if they provide the quantitative analysis necessary to replace the subjectivity in the debates with a more precise logic.

II. ALLIANCES IN INTERNATIONAL POLITICS

International politics is the set of human activities in which more or less unequal nation-states, alone or in combinations, compete in a setting of coercion to gain advantage or avoid disadvantage in the protection or advancement of their national interests.[13] Integral parts of international politics are the combinations of nations, alliances. Alliances are distinguished from other international relations by three factors. They are: (1) existence and identification of an enemy; (2) contemplation of military engagement; (3) mutuality of interest in either the preservation of the status quo or the aggrandizement of their positions.[14] Hence, alliances are a separate area of concern in the realm of international politics.

Alliances, as used herein, are relationships between two or more nation-states which include: (1) a pairing or collaboration with one another for a limited duration regarding a mutually perceived problem; (2) an aggregation of their capabilities for participation in international affairs; (3) the pursuit of national interests jointly or by parallel courses of action; (4) the probability that assistance will

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[13] Friedman, Julien R., Bladen, Christopher, and Rosen, Steven, Alliance in International Politics, p. 7, Allyn and Bacon, Inc., 1970.

[14] Ibid., p. 5.

be rendered by members to one another.[15]

As indicated previously, a distinct characteristic of alliances is the existence of a mutual enemy or enemies. Clearly then, no one country could enter or rely on an alliance for security without full appreciation of the fact that such action could lead to war.[16] In fact, alliances are sometimes credited with causing the outbreak of war or of precipitating a larger scale of involvement than would otherwise occur. The chain of events that initiated World War I is a standard example. Following that war, liberals were quick to point out that military alliances were a primary cause of war in general, and the replacement of countervailing alliances (and their corollary arms races) with a league of nations and disarmament would eliminate war. This concept was known as collective security. In principle, it meant an alliance in which an attack against one member is considered as an attack against all members. The idea being that such an alliance would always deter any aggressor. It was supposed to work automatically and call all members against the aggressor immediately.[17] This concept became manifest in the form of the League of Nations and was to have prevented the need for alliances and counter-alliances.

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[15] Ibid., p. 4-5.

[16] Ibid., P. 14.

[17] Morgenthau, Hans J., Politics Among Nations, the Struggle for Power and Peace, 5th ed., p. 193, Alfred A. Knopf, Inc., 1972.

Nevertheless, the period between World War I and World War II was marked by alliances among France, Poland, Czechoslovakia, Yugoslavia, Romania, and the Soviet Union and a counter-alliance of Germany, Italy, and Japan.[18] The concept of collective security failed to work and impeded the defensive nations from concerting their military power early enough to oppose and deter the expansion of Hitler's Germany.[19] This shows that alliances are not always good or bad but are products of the working logic of the international political system which alternates between war and peace.[20] They have maintained peace as well as contributed to the conditions leading to war.

There is another aspect of alliances that must be addressed. That is the meaning of the word commitment and what constitutes a commitment in relation to United States foreign policy and the language of the treaties. A commitment is any relationship that has the propensity to bind this country to military action in the future.[21] As such, alliances are not the only relationships considered. Statements by the President, ambassadors, or high ranking military

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[18] Ibid., P. 192-193.

[19] Osgood, Robert E. and Tucker, Robert W., Force, Order and Justice, p. 88, Johns Hopkins Press, 1967.

[20] Friedman, op. cit., p. 93.

[21] Paul, Roland A., American Military Commitments Abroad, p. 18, Rutgers University Press, 1973.

officers, establishing a military base on foreign soil, and dispatch of military advisors to aid in suppressing an insurgency are all factors which may require future military action. None of the treaties in which the United States is involved specifies what type or how many forces the United States must provide for the "common defense". The choice of weapons and amount of effort are left to the individual members of the alliance to decide for themselves.[22] Clearly, a greater degree of commitment is realized in those places where large numbers of its armed forces are present. Their presence establishes a line beyond which adversaries of the United States and its allies may not advance without becoming engaged in large-scale military operations.[23] In other types of relationships the degree to which the United States honors its commitments will depend on how consistent such action would be with American interests at the time.[24] A commitment made at the signing of the treaty may no longer coincide with American policy and may be honored reservedly, as President Nixon has stated. Likewise, when a commitment is honored, it is often obscured by the fact that such action coincides with what American policy would have been even in the absence of any commitment.[25].

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[22] Ibid., p. 20.

[23] Ibid., p. 205-206.

[24] Ibid., p. 7.

[25] Ibid.

III. BALANCE OF POWER

A balance of power is both the objective (intent) and result (perhaps unintended) of a set of coalitions among nations. The term has a long history which is, unfortunately, quite ambiguous, because it has been used to describe both the intent and the accomplishments of alliances. This chapter will address the usage of the term through history and will show that it is inapplicable to quantitative analysis.

From the days of Polybius, 175 BC, historical writings have shown that balance of power was used as a protective device by an alliance of nations against another nation's designs for world domination.[26] The concept of balance of power was most prevalent in Europe from the sixteenth century to the end of World War II. During this period, Great Britain acted as the "balancer" by aligning with the weaker nations to fight against Spain, France, Russia, Germany, and others. All this was done to preserve a rough parity among the various coalitions of the states of Europe.[27] Little effort has been made, however, to show why these particular coalitions were formed, or what each country contributed to the alliance. All that is said is that coalitions were formed because of balance of power.

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[26] Morgenthau, op. cit., p. 187.

[27] Ibid., p. 196.

The development of balance of power as a world-wide system was consummated in the First World War in which practically all nations of the world participated actively on one side of the other because of alliances or counter-alliances.[28] Since the end of World War II, the Western Alliance and Western rearmament have pursued the objective of containing the Soviet Union and Communism through the creation of a new world balance of power. The distribution of power in Europe is only one of the concrete issues over which the power contest between the United States and the Soviet Union is being waged.[29] There was the assumption by these two major powers that no Third World nation could remain unaligned. As a result, there was great competition in the form of foreign aid and military assistance to win their favor.

A nation need not enter into an alliance merely to accommodate its balance of power policy. Hans Morgenthau states at least three other ways that a balance of power may be obtained or maintained. A country may:

1) Keep its competitors weak by dividing them or keeping them divided;

2) add to the strength of weaker nations or reduce the strength of stronger nations by territorial compensation; or

3) increase its quantity or quality of armament.[30]

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[28] Ibid., p. 191.

[29] Ibid., p. 188, 201.

[30] Ibid., P. 178-181.

However, all of these may take more time or resources to accomplish than are available. Hence, a nation may pursue a policy of alliances as a matter of expediency, without considering the future costs of such a policy.[31] Nations will shun alliances when their interests and those of other countries so obviously call for concerted policies and actions that explicit formulation of these interests in the form of an alliance appears to be redundant. They will also shun alliances if they believe themselves strong enough to hold their own unaided, or if the commitments resulting from the alliance outweigh the advantages to be gained.[32]

What, then, prompted the United States to form the alliances it did in the immediate post-World War II period? In view of the preceding discussion and the powerful position of the United States in the years 1947 to 1954, the apparent answer is expediency. At that time, a formal system of alliances was the most expeditious means of delineating that territory which the United States wished to secure from communist aggression. The alliances certainly did little to augment American power at that time. However, if in the absence of an alliance, these countries would not or could not spend sufficient funds to protect themselves, then it would benefit the United States in the long run to bring those countries under its protective umbrella, if the costs of such

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[31] Ibid., p. 181.

[32] Ibid., p. 181-182.

an action were less than the costs incurred should those countries come under communist control.[33]

Whether American foreign policy-makers formed the alliances after giving consideration to the costs of such action is not known. They may have formed the alliances merely to withhold the power of these nations from their adversary, the Soviet Union and communism. For whatever reasons, the preceding argument serves to introduce the aspect of economics in relation to the subject of balance of power. Economics was applied to alliances historically as an aid in measuring power, or the ability to make war. Today, its value lies in the concept of public or collective goods.

In its historical role, economics was used to aid in the measure of power. Poland in the eighteenth century was divided equally by Russia, Prussia, and Austria in terms of the fertility of the soil and the number and quality of the population.[34] A simple division according to acres or numbers would not suffice. The parties involved had placed values on the fertility of the soil and the quality of the population. The same situation existed in Africa during the latter part of the nineteenth century and the first part of the twentieth. The European colonial powers constructed numerous treaties among themselves delineating spheres of influence. Consideration was given to the economic gains that could be made by a country

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[33] Russett, op. cit., p. 124.

[34] Morgenthau, op. cit., p. 179.

in the areas assigned to it, and care was taken to ensure that the distribution of power remained unchanged.[35]

The application of economics to alliances today is in the area of collective goods or external economics. As an example, whenever two or more nations have a common enemy, and one of those nations does something to weaken the common enemy, there will be produced a collective good, namely, a weaker enemy, from which all other nations will benefit.[36] The actions of the one country produced a collective good. When all nations sharing this common enemy perform similar actions, then each provides a collective good for all others. The problem, then, is that these countries, by only viewing their own position relative to the enemy, spend more for defense than they would if they combined their efforts in the form of an alliance. This concept is discussed by Mancur Olson, Jr. and Richard Zeckhauser in their economic theory of alliance (See Chapter IV).

Both the historical and present use of the concept of balance of power fail to address specifically what is being balanced. The term power remains undefined. It is a perceptual item having meaning only to the user and has quantity only in a relative sense. That is, the user, the current head-of-state or foreign policy-maker, sees the power of one

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[35] Ibid.

[36] McKean, Roland N., Issues in Defense Economics, p. 27, Columbia University Press, 1967.

country as being greater or lesser than that of another. He can thus establish an ordinal ranking but cannot quantify the power differential between the two. Another head-of-state may perceive a different power distribution and arrive at a different ranking. Any distribution of power is highly tenuous.

By way of example, there is a current argument that can be cited. President Nixon and Secretary of State-elect Kissinger perceive the world as having five poles, the United States, Europe, Soviet Union, China, and Japan, in an even balance of power. Zbigniew Brzezinski, a foreign policy analyst, views the world as having $2\frac{1}{2} + y + z$ poles. The United States and the Soviet Union represent two poles because they hold both military and economic power. China is represented as $\frac{1}{2}$ a pole because it holds only military power. Europe and Japan are the unknown quantities because they hold only economic power with no clear political purpose.[37] Obviously, the two views are not based on the same perception of power, and yet both parties are in the same country. Adding more countries' views can only further cloud the issue.

A model that merely describes what has previously happened is of little value. To be truly useful, it should have some predictive ability. The balance of power concept has been used exclusively for the purpose of describing why alliances were formed. It does not provide insight to the question of what alliances will form. Further, it does not give any

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[37] Brzezinski, Zbigniew, "The Balance of Power Delusion", Foreign Policy, v. 7, p. 54-56, Summer, 1972.

information on how nations in an alliance are to function or bear the burden of defense. Finally, the very subjective nature of balance of power prohibits its use as an analytical tool.

IV. AN ECONOMIC THEORY OF ALLIANCES

This chapter addresses the model derived by Mancur Olson, Jr. and Richard Zeckhauser. This model is an application of the theory of public or collective goods to alliances and other small groups. It will be shown that the model quantitatively answers the questions on burden-sharing in alliances, but the assumptions on which it is based limit its applicability.

Since this model addresses the subject of collective goods, some discussion on that topic is necessary. Collective goods are characterized by having two distinct properties, nonexclusiveness and nonrivalness. Nonexclusiveness means that benefits are made available to all members of the group. That is, it is not feasible to exclude nonpurchasers from the benefits accrued by the group. Nonrivalness means that each individual's consumption leads to no subtraction from the supply available to others.[38]

Deterrence, on a national level, is clearly a public good. An attack by a foreign power on any state in the United States will meet with as strong a reaction as a similar attack on any other state, an example of nonexclusiveness. Similarly, the cost of providing deterrence against attack for Pennsylvania does not increase the cost once it is provided for the rest of the country, an example of nonrivalness.[39]

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[38] Russett, op. cit., p. 94.

[39] Ibid.

Olson and Zeckhauser assume that these principles apply to military alliances in much the same manner. Thus, by assuming that deterrence, a benefit of a military alliance, meets the properties of a collective good, they are able to apply that theory to the subject of alliances.

This is a very strong assumption, because deterrence in a military alliance, as opposed to the situation on the national level, may not possess the property of nonexclusiveness.[40] In NATO, for example, the amount of deterrence against attack on Europe provided by the United States is not necessarily the same as the amount provided for itself. Also, the amount of deterrence provided for each ally may not be the same. Canada and Turkey, although both members of NATO and entitled to equal amounts of deterrence, may not receive equality due to geographical differences if nothing else. Further, deterrence is not the only good produced by a military alliance. An alliance also provides defense, or a damage-limiting capability, should deterrence fail, and defense is not a collective good.[41] The means of defense may not provide security equally to all members of the alliance. Therefore, some members may be excluded from the benefits of defense, and each ally will surely place a higher priority on its own defense than on any other's.[42]

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[40] McKean, op. cit., p. 61.

[41] Russett, op. cit., p. 97.

[42] McKean, op. cit., p. 60.

The benefits of a military alliance may not necessarily be collective goods. Arguments can be made both pro and con. Olson and Zeckhauser make the assumption that, in peacetime, alliances produce deterrence which is a collective good. Without this assumption, the theory of collective goods is inapplicable. For the purpose of this study, this assumption is considered valid.

The authors make three other assumptions which are also of questionable validity. However, they stress the point that these are simplifying assumptions without which the analysis would become quite cumbersome. These assumptions are:

1) The costs of defense are constant to scale and the same for all members;

2) military forces in an alliance provide only the collective benefit of alliance security; and

3) no alliance member will take into account the reactions other members may have to the size of their alliance contribution.[43]

A brief discussion of each of these is necessary to highlight the potential weaknesses of their model.

The authors realized that their first assumption was weak. Clearly, the nations may not value all alliance forces and equipment the same. Smaller, less industrialized nations may place higher value on sophisticated equipment than larger nations because of the costs incurred in other sectors of

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[43] Friedman, op. cit., p. 184-188.

their economy as a result of developing such equipment. Similarly, the smaller nations with lower per capita income than larger nations may have less difficulty in recruiting manpower. Olson and Zeckhauser believed these effects to be negligible, so they assumed that costs of defense were constant to scale and the same for all members.

Their second assumption is of questionable validity. An increase in military forces by an alliance member for purely national purposes, the United States in Vietnam, for example, provides an additional benefit for all alliance members. Likewise, an increase in military forces as a contribution to the alliance by a nation gives that nation additional capabilities for internal security as well. Certainly, military forces in an alliance do not provide only the collective benefit of alliance security.

The third assumption, that no alliance member will take into account the reactions other members may have to the size of their alliance contribution, is a subject of concern in itself. Olson and Zeckhauser contend that the advantage in any bargaining about relative contributions to the alliance rests with the smaller nation for two reasons. First, the large country loses more from withholding an alliance contribution than a small country does, since it values a given amount of alliance force more highly. That is, it may be deterred by the very importance to itself of its own contribution from carrying out any threat to end that contribution.[44]

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[44] Ibid., p. 189.

Secondly, the contribution of the smaller nation will be small. Hence, the larger country has less to gain that its smaller ally from driving a hard bargain.[45]

Although exceptions and arguments can be made for and against these assumptions, they are, as the authors elucidate, for the purpose of simplification. They are considered valid for the purpose of this study.

Before addressing the model itself, there is one more subject that must be discussed. This is the subject of inferior, normal, and superior goods. When an increase in real income results in an increase in consumption of a good and a decrease in real income results in a decrease in comsumption of a good, then that good is called a normal good.[46] Not all goods are normal, however. When real income increases and at the same relative prices, consumption of a good decreases or real income decreases and consumption of a good increases, that good is called inferior.[47] When real income increases and all of the increase in income is used to purchase a good, then it is termed a superior good.[48] The authors consider deterrence to be a normal good, but mention special cases that occur when it is an inferior or a superior good. Hopefully, these

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[45] Ibid.

[46] Mansfield, Edwin, Microeconomics: Theory and Applications, p. 65, W. W. Norton and Co., Inc., 1970.

[47] Ibid.

[48] Friedman, op. cit., p. 183.

definitions will aid in clarifying those special cases discussed by the authors in their model.

The model derived by Olson and Zeckhauser is quoted in its entirety in Appendix B. For a more precise understanding of the remainder of this chapter, it is suggested that the reader peruse that appendix before reading further.

From their analysis, Olson and Zeckhauser conclude that, in equilibrium, the defense expenditures of the members of an alliance are such that the "larger" nations, the ones that place a higher valuation on the alliance good, will bear a disporportionately large share of the common burden.[49] This implies that nations in an alliance follow a risk aversion principle. That is, they have utility functions that are concave to the origin, and they value deterrence as a normal good. As their incomes increase, they want to buy more of the alliance good. This reasoning was stated as hypotheses with which they tested their model.

The hypotheses tested were:

> "H_1 - In an alliance, there will be a significant positive correlation between the size of a member's national income and the percentage of its national income spent on defense. This hypothesis will be tested against:
>
> "H_0 - There will not be a significant positive correlation between the variables specified in H_1."[50]

They use GNP as a measure of the size of a country's national income and D/GNP (military expenditures as a percentage of GNP) as an indicator of effort to provide

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[49] Ibid., p. 181.

[50] Ibid., p. 190.

defense. GNP is used rather than area, population, or some other measure, because it is really the implicit variable in the theory. D/GNP is not flawless due to the incomparabilities of the measure between nations, but the distortions are not so great as to prevent its use.[51] The data used was from NATO for 1964, listed in Table I, and Spearman's rank-order correlation was used to test the hypotheses. Olson and Zeckhauser found their results to be significant at the .05 level for a one-tailed 't' test and accepted their hypothesis H_1.[52] Ypersele and Pryor have also tested the same relationship at two different points in time (1955 and 1963, and 1956 and 1962, respectively) and found positive correlations.[52] However, the same test on data in 1970 (Table II) revealed no significant positive correlation. Similar tests of the hypotheses on 1970 data for the Arab League (Table IV) also revealed no significant positive correlation of GNP to D/GNP. Yet SEATO (Table III), the Warsaw Pact (Table V), and the Rio Pact (Table VI) all reveal significant positive correlations. Based on these results, there appears to be insufficient evidence to accept or reject either hypothesis as stated.

It would be unfair to discredit this model because it lacks universal application. Obviously, there are many

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[51] Russett, op. cit., p. 101.

[52] Friedman, op. cit., p. 190.

[53] Russett, op. cit., p. 101.

situations which cannot be included in the model or assumed away. Members of an alliance may spend more than expected for several reasons. Some of these reasons are because:

1) They lack confidence in the ability of the large power to deter attack;

2) they seek private goods, such as internal security or research and development, from their military spending; and

3) they are coerced by the large power into spending more than they would normally.[54]

Military alliances may be formed for different functions. NATO was organized to deter communist aggression in Europe. The alliance formed by the Arab states is more for the purpose of making war on Israel. Finally, nations may suddenly change their utility functions, making defense spending an inferior good. When this occurs, as Olson and Zeckhauser point out, there may be more than one equilibrium point, and all will be unstable.

All of the above discussed reasons, and certainly more, contribute to conditions under which the model will not hold. As a result, their hypothesis on burden-sharing will not always be correct. These factors may explain why data on some alliances failed to support their conclusions, and others did.

Their model does not give any information on how the equilibrium point is reacquired. There is no description

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[54] Ibid., p. 99-100.

of the bargaining process involved among the nations, or how the utility functions of these nations must change to make defense a normal good again. The model deals only with the situation when the alliance is in equilibrium and their assumptions are met. There will be periods of time when it is inapplicable. These periods may be measured in terms of years, and there is no information given as to how alliances will operate or the burden shared during these periods.

The Olson and Zeckhauser model provides some quantitative analysis of alliances, and it gives insight to the question of burden-sharing. However, it only applies when the alliance is in an equilibrium state and when the assumptions are met, which may occur quite infrequently. The model has value but that value appears to be somewhat limited.

TABLE I[55]

NATO Statistics: 1964

Country	GNP (Billions of Dollars)	Rank	D/GNP (%)	Rank
United States	569.03	1	9.0	1
Germany	88.87	2	5.5	6
United Kingdom	79.46	3	7.0	3
France	73.40	4	6.7	4
Italy	43.63	5	4.1	10
Canada	38.14	6	4.4	8
Netherlands	15.00	7	4.9	7
Belgium	13.43	8	3.7	12
Denmark	7.73	9	3.3	13
Turkey	6.69	10	5.8	5
Norway	5.64	11	3.9	11
Greece	4.31	12	4.2	9
Portugal	2.88	13	7.7	2
Luxembourg	.53	14	1.7	14
Iceland	.40	15	-	15

rho = 0.586

t = 2.6077

df = 13; one-tailed test; Significant @ 95%

[55] Friedman, op. cit., p. 177.

TABLE II[56]

NATO Statistics: 1970

Country	GNP (Billions of Dollars)	Rank	D/GNP (%)	Rank
United States	974.1	1	8.0	1
Germany	186.3	2	3.3	7
United Kingdom	121.0	3	4.8	4
Italy	93.2	4	2.7	9
Canada	84.7	5	2.2	11
Netherlands	31.2	6	3.5	6
Belgium	25.7	7	2.7	9
Denmark	15.6	8	2.4	10
Turkey	9.0	11	4.6	5
Norway	13.4	9	3.0	8
Greece	9.5	10	5.0	3
Portugal	6.2	12	7.0	2
Luxembourg	1.0	13	.8	12
Iceland	.5	14	-	13

rho = 0.378

t = 1.417

df = 12; one-tailed test; not significant @ 95%

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[56] USACDA, op. cit., p. 10.

TABLE III[57]

SEATO

Country	Billions GNP (1970)	Rank	% D/GNP	Rank
United States	974.1	1	7.98	1
United Kingdom	121.0	3	4.84	2
France	147.5	2	4.05	3
Australia	32.99	4	4.02	4
Pakistan	17.5	5	3.72	5
New Zealand	5.33	8	1.96	7
Philippines	10.23	6	1.21	8
Thailand	6.51	7	3.60	6

rho = 0.904

t = 5.188

df = 6; one-tailed test; significant @ 95%

[57] Ibid., p. 10-13.

TABLE IV[58]

Arab League

Country	GNP	Rank	D/GNP	Rank
Egypt	6.58	1	13.9	2
Algeria	4.18	2	2.3	11
Morocco	3.34	3	2.8	9
Iraq	2.69	6	11.0	5
Kuwait	2.75	5	10.8	6
Saudi Arabia	3.14	4	13.3	4
Sudan	1.89	7	6.1	7
Syria	1.59	8	13.8	3
Lebanon	1.52	9	3.4	8
Tunisia	1.22	10	1.8	12
Libya	3.14	4	1.4	13
Jordan	.575	12	20.5	1
Yemen	.600	11	2.5	10

rho = 0.0302

t = 0.1002

df = 11; one-tailed test; not significant @ 95%

[58] Ibid.

TABLE V[59]

Warsaw Pact

Country	GNP	Rank	D/GNP	Rank
Bulgaria	9.8	7	3.16	6
Czechoslovakia	30.5	4	5.44	4
East Germany	32.3	3	6.81	2
Hungary	14.3	6	3.91	5
Poland	39.4	2	5.71	3
Romania	22.3	5	2.73	7
Soviet Union	497.0	1	13.08	1

rho = 0.857

t = 3.72

df = 5; one-tailed test; significant @ 95%

[59] Ibid.

TABLE VI[60]

Rio Pact

Country	GNP	Rank	D/GNP	Rank
United States	974.1	1	7.98	1
Brazil	35.44	2	2.87	3
Mexico	33.0	3	.67	17
Argentina	23.83	4	2.15	5
Venzuela	10.3	5	1.98	8
Colombia	7.07	6	1.37	14
Chile	6.67	7	2.50	4
Peru	4.80	8	4.08	2
Uruguay	2.14	9	2.05	6
Guatemala	1.78	11	1.62	11
Ecuador	1.80	10	1.44	13
Dominican Republic	1.50	12	2.00	7
El Salvador	.997	14	1.10	15
Panama	1.016	13	.19	18
Bolivia	.976	15	1.94	9
Costa Rica	-	-	-	-
Nicaragua	.772	16	1.55	12
Honduras	.685	17	1.02	16
Paraguay	.600	18	1.83	10
Haiti	.360	19	1.94	9

[60] Ibid.

TABLE VI (Continued)

rho = 0.472

t = 2.20

df = 17; one-tailed test; significant @ 95%.

V. CONCLUSIONS

In this paper, two prominent concepts for explaining alliance formation were considered. These concepts were balance of power and the theory of collective goods. They were studied to determine if they could provide some quantitative analysis on the subject of burden-sharing in alliances.

The balance of power philosphy which has persisted for centuries is far too subjective and does not lend itself to quantitative analysis. The result is that no precise information can be gained by its application.

The economic theory of alliances authored by Olson and Zeckhauser provides information on the much discussed subject of burden-sharing. However, their major conclusion, a positive correlation exists between the size of a country's income and the size of its contribution to the alliance, occurs only when the alliance is in equilibrium and when their other assumptions are met. This may occur infrequently, which limits the applicability of the model.

It is significant to note that at a time when the United States is undergoing a revision of its foreign policy and definitive answers are needed on the subject of alliances, no precise model for quantitative analysis is available. Hopefully, the subjective analysis that will surely ensue on this subject will determine the correct policy.

APPENDIX A

MUTUAL SECURITY TREATIES[61]

	Treaty	Year Signed	Countries Involved[62]
1.	Inter-American Treaty of Reciprocal Assistance (Rio Treaty) (20 Countries)	1947	Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Paraguay, Panama, Peru, Trinidad, Uruguay, Venezuela.
2.	North Atlantic Treaty (13 Countries)	1949	Belgium, Canada, Italy, Denmark, West Germany, Greece, Iceland, Luxembourg, Netherlands, Norway, Portugal, Turkey, United Kingdom.
3.	Mutual Defense Treaty between United States and Philippines	1951	Philippines.
4.	ANZUS	1951	Australia, New Zealand.
5.	Mutual Cooperation and Security between United States and Japan	1952 (Superseded in 1960)	Japan
6.	Mutual Defense Treaty between United States and South Korea	1953	South Korea
7.	Southeast Asia Collective Defense Treaty (SEATO)	1954	Australia, France, New Zealand, Pakistan, Philippines, Thailand, United Kingdom, free territory of South Vietnam as a protocol state.
8.	Mutual Defense Treaty between United States and Nationalist China	1954	Nationalist China
			Total: 42 plus South Vietnam.

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[61] Paul, op. cit., p. 14-15

[62] other than United States

APPENDIX B

AN ECONOMIC THEORY OF ALLIANCES[63]

When a nation decides how large a military force to provide in an alliance, it must consider the value it places upon collective defense and the other, non-defense, goods that must be sacrificed to obtain additional military forces. The value each nation in an alliance places upon the alliance collective good vis-a-vis other goods can be shown on a simple indifference map, such as is shown in Figure 1. This is an ordinary indifference map cut off at the present income line and turned upside down. Defense capability is measured along the horizontal axis and valued positively. Defense spending is measured along the vertical axis and valued negatively. The cost curves are assumed to be linear for the sake of simplicity. If the nation depicted in Figure 1 were not a part of any alliance, the amount of defense it would obtain (OB) could be found by drawing a cost curve coming out of the origin and finding the point (point A) where this cost curve is tangent to the "highest" (most southeasterly) indifference curve.

In an alliance, the amount a nation spends on defense will be affected by the amount its allies provide. By moving the cost curve down along the vertical axis beneath the origin we

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[63] Friedman, op. cit., p. 178-184.

can represent the defense expenditure of allied nations as the distance between the origin and the juncture of the cost curve and the vertical axis. If a nation's allies spend OD on defense, and their cost functions are the same as its own, then it receives OH of defense without cost. This is directly equivalent to an increase in income of OD. The more defense this nation's allies provide, the further the cost constraint moves to the southeast, and the less it spends on defense. By recording all the points of tangency of the total cost curve with the indifference curves, we can obtain this nation's reaction function. The reaction function indicates how much defense this nation will produce for all possible levels of defense expenditure by its allies. The amount of defense that this nation provides will in turn influence the defense output of its allies, whose reaction curves can be determined in the same way.

Figure 2 shows the reaction curves for a two-country model (which can easily be generalized to cover N countries). The intersection point of the two reaction curves indicates how much of the alliance good each ally will supply in equilibrium. The two reaction curves need not always intersect. If one nation has a very much larger demand for the alliance good than the other, its reaction curve may lie at every point outside that of the other, in which case it will provide all of the defense. The equilibrium output will then be the same as the isolation output of the country with the largest isolation output. Whether the reaction curves intersect or not, the equilibrium output is necessarily

determinate and stable unless defense is an inferior good, in which case there may be a number of equilibria, one or more of which may be unstable.

In equilibrium, the defense expenditures of the two nations are such that the "larger" nation - the one that places the higher absolute value on the alliance good - will bear a disproportionately large share of the common burden. It will pay a share of the costs that is larger than its share of the benefits, and thus the distribution of costs will be quite different from that which a system of benefit taxation would bring about. This becomes obvious when income effects - i.e., the influence that the amount of non-defense goods a nation has already forgone has on its desire to provide additional units of defense - are neglected. This is shown in Figure 3, which depicts the evaluation curves of two nations for alliance forces. The larger nation, called Big Atlantis, has the higher, steeper valuation curve, V_B, because it places a higher absolute value on defense than Little Atlantis, which has evaluation curve V_L. The CC curve shows the costs of providing defense capability to each nation, since both, by assumption, have the same costs. In isolation, Big Atlantis would buy B_1 units of defense and Little Atlantis L_1, for at these points their respective valuation curves are parallel to their cost functions. If the two nations continued to provide these outputs in alliance each would enjoy B_1 plus L_1 units of defense. But then each nation values a marginal unit at less than its marginal cost. Big Atlantis will stop reducing its output of deterrence when the sum applied by the

two nations together is B_1. When this amount (or any amount greater than L_1) is available, it is not in Little Atlantis' interest to supply any defense whatever. The two nations are therefore simultaneously in equilibrium only when Big Atlantis provides B_1 of defense and Little Atlantis provides no defense whatever.

The disproportionality in the sharing of burdens is less extreme when income effects are taken into account, but it is still important. This can be seen most easily by supposing that Big Atlantis and Little Atlantis are identical in every respect save that Big Atlantis is twice the size of Little Atlantis. Per capita incomes and individual tastes are the same in both countries, but the population and GNP of Big Atlantis are twice that of Little Atlantis. Now imagine also that Big Atlantis is providing twice as much alliance defense as Little Atlantis, as proportionality would require. In equilibrium, the marginal rate of substitution of money for the alliance good (MRS) must equal marginal cost for each of these countries, i.e., $MRS_{Big} = MRS_{Little}$ = marginal cost. But (since each country enjoys the same amount of the collective good) the MRS of Big Atlantis is double that of Little Atlantis, and (since the cost of an additional unit of defense is the same for each country) either Big Atlantis will want more defense or Little Atlantis will want less (or both will be true), and the common burden will come to be shared in a disproportionate way.

There is one important special case in which there will be no tendency toward disproportionality. That is when the

indifference maps of the member nations are such that any perpendicular from the ordinate would intersect all indifference curves at points of equal slope. In this case, when the nation's cost constraint moves to the right as it gets more free defense, it would not reduce its own expenditure on defense. In other words, none of the increase in income that the nation receives in the form of defense is spent on goods other than defense. Defense in this situation is, strictly speaking, a "superior good", a good such that all of any increase in income is used to buy the good.

This special case may sometimes be very important. During periods of all-out war or exceptional insecurity, it is likely that defense is (or is nearly) a superior good, and in such circumstances alliances will not have any tendency toward disproportionate burden sharing. The amount of allied military capability that Great Britain enjoyed in World War II increased from 1941 to 1944 as the United States mobilized, adding more and more strength to the allied side. But the British war effort was maintained, if not increased during this period.

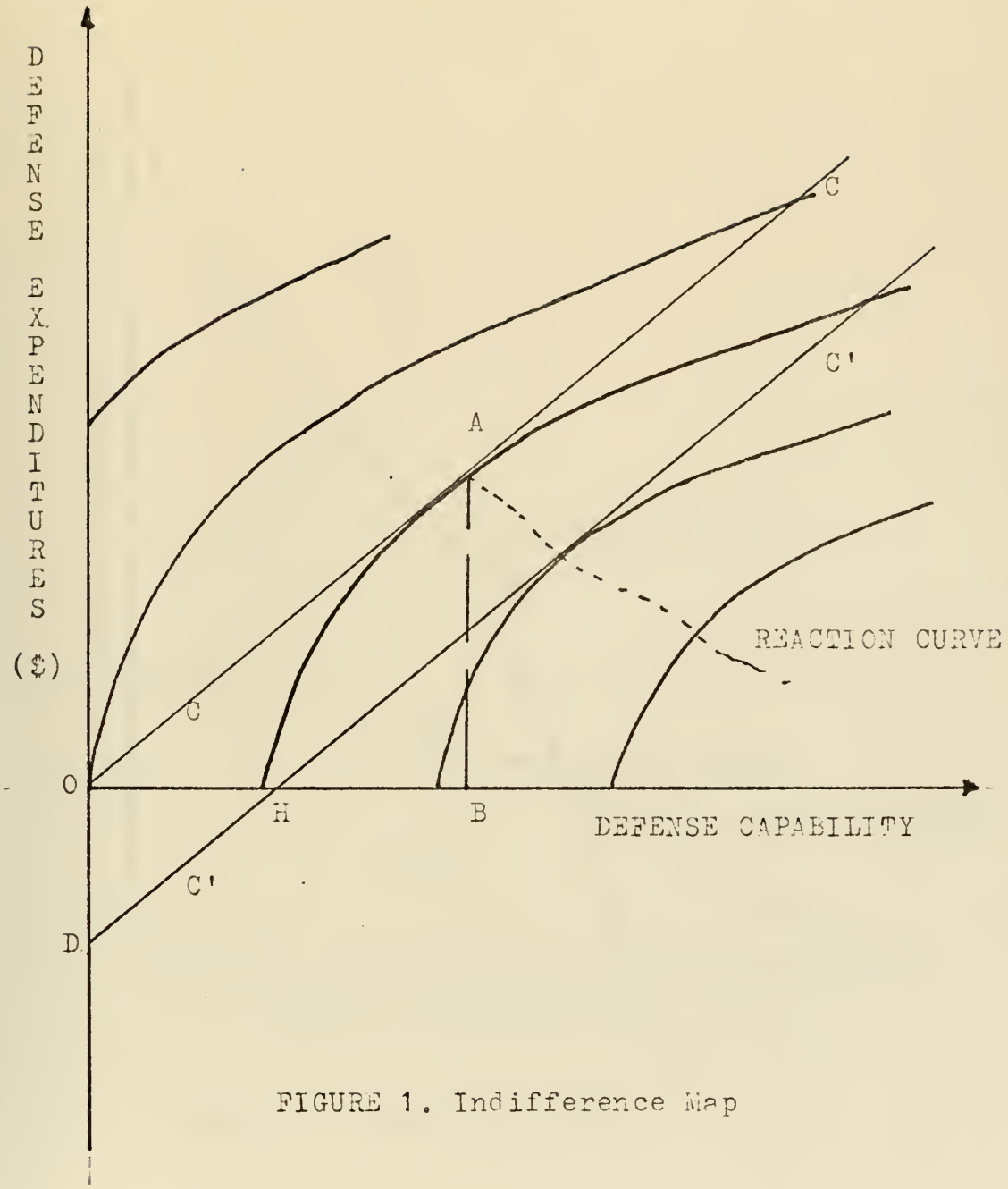

FIGURE 1. Indifference Map

FIGURE 2. Reaction Curves

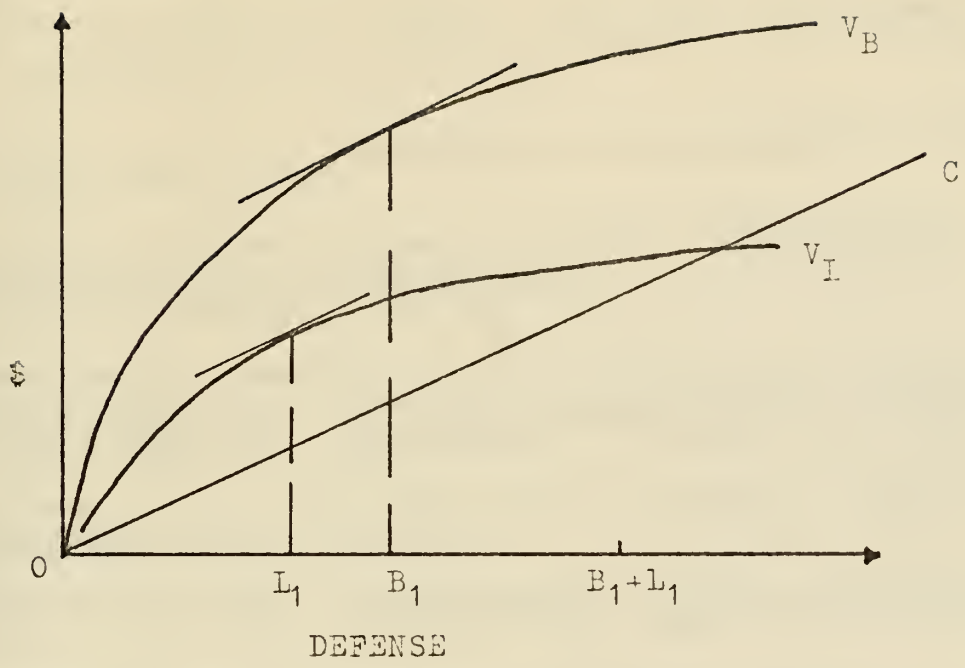

FIGURE 3. Evaluation Curves

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4. TITLE (and Subtitle) Economic Burden-Sharing in Military Alliances		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis: September 1973 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) CPT Larry Eugene Delp		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		12. REPORT DATE September 1973 13. NUMBER OF PAGES 55
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Naval Postgraduate School Monterey, California 93940		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Military Alliances
Economic Burden-Sharing
Theory of Collective Goods

20. ABSTRACT (Continue on reverse side if necessary and identity by block number)

It has been claimed that the United States is bearing a disproportionate share of the burden of the alliance system in which it is involved. In this thesis, two prominent concepts used for explaining military alliances, balance of power and the theory of collective goods, were studied to determine if they provide precise answers on the subject of burden-sharing. It was concluded that the balance of power

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20. ABSTRACT (Continued)

philosophy is far too subjective to provide any precise answer. On the other hand, the theory of collective goods, as authored by Olsen and Zeckhauser, yields the conclusion that a positive correlation exists between the size of a country's income and the size of its contribution to the alliance. However, their conclusion holds only when the alliance is in equilibrium and when their other assumptions are met. It is, therefore, of limited applicability.

Thesis
D2984 Delp
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146494
Economic burden-sharing in military alliances.